AMENDMENTS TO THE SPECIFICATION:

Please replace the paragraph on page 1, beginning at line 27, continuing to page 2, line 12, with the following amended paragraph:

Diffraction, interference and processing effects that occur during the transfer of the image pattern causes the image or pattern formed at the substrate to deviate from the desired (i.e. designed) dimensions and shapes. These deviations depend on the interaction of the pattern configurations with the process conditions, and can affect the yield and performance of the resulting microelectronic devices. Various ~~techniques~~ technologies have been used to compensate for and correct for these deviations. Such ~~techniques~~ technologies are ~~include~~ known as optical proximity correction (OPC), for example, by biasing selected mask features to compensate for deviations. Other ~~techniques~~ technologies for compensating for such diffraction, interference and processing effects include using sub-resolution assist features (SRAFs), also known as scattering bars or intensity leveling bars, to improve the uniformity of grating characteristics of the mask, and thereby improve optimization of lithographic process conditions for the mask. Phase shifted mask technology (PSM) has also been used to improve the contrast of image features by destructive interference, and thus improve resolution. These and other various ~~techniques~~ technologies for improving the lithographic process are generally referred to as resolution enhancement ~~techniques~~ technologies (RETs). ~~The use of RET to improve lithographic processes are known in the art, for example, as described in Liebmann et al., "TCAD development for lithography resolution enhancement", IBM J. Res. & Dev., Vol. 45, No. 5, Sept. 2001 (hereinafter "Liebmann et al."), the contents of which are hereby incorporated by reference in its entirety. Liebmann et al. describes how RETs, such as OPC, SRAFs, and PSM are used to improve the resolution of optical lithography, and in particular, discloses that model-based OPC includes the use of mathematical models to predict the images, and then iteratively correct the layout until the resulting image matches a desired target image.~~

Please replace the paragraph on page 2, beginning at line 13, with the following amended paragraph:

Prediction of the partially coherent images resulting from illumination in a modern lithographic scanner is of paramount importance as looming technology nodes stress the use of Resolution Enhancement Technologies (RETs), such as SubResolution Assist Features (SRAFs) and Alternating Phase-Shift Masks (AltPSM). Without fast and accurate simulation, it would be impossible to employ a strong RET solution in a practical setting. The reason for this is because simulations have made the transition from learning/research tool to a major ingredient in the design stage. It is known in the art that there are a number of ways that lithographic processes may be improved by using simulated aerial images, including, but not limited to, the following examples. For example, in co-assigned US Patent 6,421,820, to Mansfield et al., the disclosure of which is hereby incorporated by reference in its entirety, discloses using OPC, including model-based OPC, to improve the design of SRAFs in a photomask layout. In another example, co-assigned US Patent 6,223,139 to Wong et al., the disclosure of which is hereby incorporated by reference in its entirety, discloses that aerial image simulators have found wide-spread application in advanced mask designs, e.g., phase-shifting mask (PSM) design, optical proximity correction (OPC) in automated inspection of PSMs and OPC masks, and in the design of projection optics, e.g., pupil and illumination filters. ~~In yet another example, co-assigned US Patent 6,869,739 to Ausschnitt et al. (hereinafter "Ausschnitt et al."), the disclosure of which is hereby incorporated by reference in its entirety, discloses a metrology method and system that evaluates the effect of dose and focus during lithographic processing, including the creating simulated aerial images of the object pattern to be transferred to a resist film on the substrate at different focus settings of the metrology imaging system.~~ However, in practice, only a portion of a mask pattern can be simulated at a time, to allow for reasonable computation times.

Please replace the paragraph on page 2, beginning at line 22, continuing to page 3, line 7, with the following amended paragraph:

The ability to accurately predict the resulting aerial image, latent image and/or etched pattern due to the lithographic and etch processes is crucial for ensuring sufficient manufacturing yields and reducing costs of manufacturing. The aerial image of a mask pattern is the distribution of intensity at the plane of the wafer or resist surface. The accurate simulation of the aerial image is key in the design of photomasks, for example, by model-based optical proximity

correction (model-based OPC). In model-based OPC, for given lithographic process conditions (e.g. illumination source parameters, numerical aperture (NA) and partial coherence (σ_0) of the lithography tool, specified exposure dose and defocus, etc.), and an initial mask design, the resulting image is simulated. In the model-based OPC process, the simulated image is compared to the target (desired) design, and deviations from the desired image are determined ~~(see, for example, Liebmann et al.)~~. The mask design is iteratively modified until the simulated image agrees with the target design within an acceptable tolerance. Thus the accuracy of the simulated image is crucial in obtaining viable mask designs, and the speed of such calculations impacts the cost of designing the masks.

Please replace the paragraph on page 3, beginning at line 17, with the following amended paragraph:

To get an idea of what sort of accuracy is required in simulation, consider that the aerial image simulator can be viewed as a metrology tool ~~(see, for example, Ausschnitt et al.)~~. There is an inherent uncertainty in metrology, for example in using metrology techniques such as (scanning electron microscope) SEM, in which a target to be measured is bombarded with electrons, which in turn produce a signal, indicating, for example, line widths in the target. However, there is an inherent uncertainty in these measurements, for example, caused by charge damage to features on the target. The precision to tolerance ratio (P to T ratio) is the ratio of the precision, or accuracy, of the metrology tool to the tolerance specification for the device being measured. The specification for line widths (CD) may be, for example, 90 nm, within 3 sigma. The demand on the line width distribution is such that CD has a mean value of 90 nm, wherein the 3 sigma variation is within 5% of 90 nm (e.g. ±4.5 nm tolerance). A typical spec for P-T ratio is to measure the line within a small fraction of 4.5 nm (e.g. 20% or 0.90 nm or 9.0 Angstroms). A simulation tool should provide numerical accuracy in a similar vein as the metrology tools specifications, e.g. within .90 nm. One conventional method of simulating aerial images is to use a gridding algorithm, as in the prior art outlined above, but in order to obtain the precisions required, to obtain the required precision, the smaller grid sizes result in a large number of gridding intervals, which in turn result in impractical computation times. Such

gridding methods cannot be used to simulate large portions of a mask in a practical amount of time.